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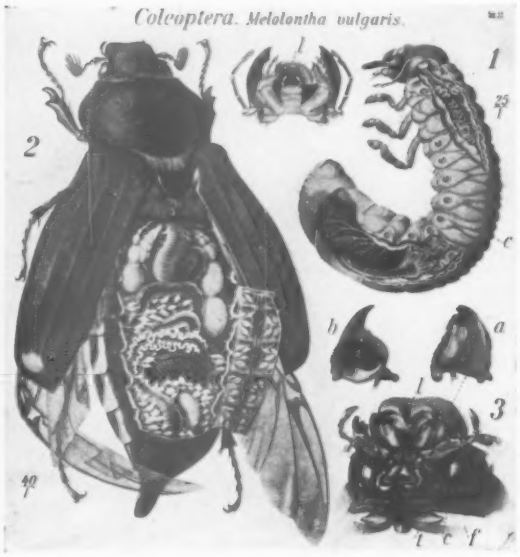

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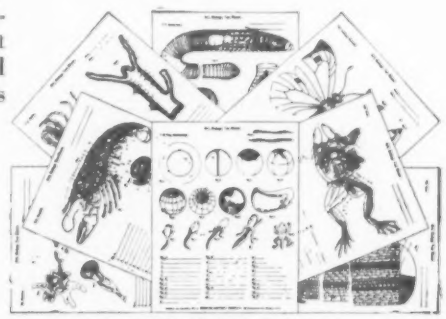

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The Most and Least Helpful Features of a Biology Text as Seen by Students in Course

CHARLES E. PACKARD
Randolph-Macon College, Ashland, Virginia

An author has the instinctive interest of an artist in creating his book. The publisher's stake in the production sponsored is likewise not small. A teacher approaches the adoption of a text from a somewhat different direction yet not without concern. The student usually suffers the consequences, whatever they may be, and constitutes at best a rather forgotten factor in the quadruple situation.

Much depends on the producer. If he has done his work well the other three parties should be satisfied. But the users sometimes are not, for they are human, individualistic, and not too well informed. Mankind likes variety. Tastes differ within wide ranges. This makes for change and prevents stagnation. The factor of ignorance is overcome with experience. The writer who does not keep his effort up-to-date and fresh in appeal soon finds himself without a market. He should welcome proper reactions from his clientele, and mostly does.

A textbook, fine in all essentials, is an indispensable tool for good teaching. It was the original well-organized visual aid and still retains great appeal to brain and mind through the medium of the eye. Its illustrations become ever more attractive and effective. The photograph has been adapted to the teaching page with excellent results. As a direct issue from so many modern improvements today's product is a very finished affair, uniformly pleasing and fruitful.

Teachers generally like to choose a readable text with appeal, one calculated to meet with a favorable reception by the users. If the choice is not well received repercussions follow, sooner or later. Perhaps too frequently the initiative for discovering how the selection is accepted does not stem from instructional sources. Checks may, however, be made without too great difficulty and lead to important consequences. Recently two brief questions were asked, calling for short, to-the-point answers, but non-

compulsory, of a class of forty-one in a course catalogued as *Introductory Biology*. The main text used has had a successful run, is authoritatively written, and has been revised to keep factual content reasonably new.

The questions were (1) What was the most helpful feature of your text? (2) What proved to be the least helpful to you? The course itself forms part of a cultural science program and is often referred to as *Human Biology*. This title is not completely accurate since all phases of human biology are not discussed. It is essentially, in content, human anatomy, physiology, and hygiene. The thirty-six replies to question one, and the thirty-four submitted to number two have been condensed for tabulation. They reflect the substance of the outline followed for teaching purposes. In a number of instances a student included more than one point in his response.

Most Helpful Feature

Treatment of Reproductive System (Diseases, Prostate)	8
" " Systems as a Whole	5
" " Diseases in General	4
" " Circulatory System (Heart function, Ailments, Heart diagram)	3
" " Nervous System (Insanity)	3
" " Excretory System (Kidneys) and General Health Problems, one each	2
Text Features (Organization, Style, General)	
Explanations	6
Well-Written Subject Matter	6
Illustrations, Diagrams	4
Complete Index	3
Easy Reading (Understandable)	2
Heavily Printed Headings, Sticking to Subject, All Chapters Excellent, one each	3

Such descriptive adjectives as "careful, clear, interesting, detailed, understandable" were used to apply to these various helpful properties. It was not intended that an exhaustive survey be made but that only a single quality should be decided upon. No doubt many could have written at some length upon the diverse manner in which the book had proved useful. Some could not forbear mentioning more than one.

Unfavorable criticisms are not as easy to categorize, tended to be longer. The following constitutes a fairly accurate summary.

Least Helpful Feature

Clearness, Explanation, Understandable	9
Technical descriptions sometimes difficult; certain diagrams incompletely labeled; digestion and circulation not explained well; occasional unexplained words; definitions not always clear ("placenta"); certain explanations poor; some deviations from topics; more diagrams of muscles, bones and nerves would add to understanding; failed to integrate functions of systems effectively.	
Detail	7
Too many unnecessary medical terms; too much emphasis on unimportant things; skeletal system had too many bones to memorize; too much unnecessary material for time allowed; too detailed explanations of various diseases; could have had less about technical and secondary problems.	
Presentation	4
Could have been more objective; some chapters too long; treatment of minor diseases too great; arrangement of some chapters and systems could have been better.	
Digestion (Enzymes, Vitamins)	4
Heredity (Too wordy, not clear)	2
Some Diseases ("Allergys"!)	2
Poison Gases	2
Table of Contents, Diagrams, Tooth Structure, Urinary, Nervous, Muscular, Bone Systems, one each	7
Price of Book (!)	1

Thus the favorable points with a score of forty-seven outnumber the unfavorable ones which total thirty-eight. The following was included with the undesirable qualities and is quoted in full: "He did not expressed himself well on the sex of life, the unbibluca cord has not expressed very well at all." This choice sample of illiteracy rules itself out by default.

How the author might answer his critics can be readily imagined. Indeed, the validity of a number of judgments, at least, is decidedly open to question. For example, only a selected list of the more prominent and conspicuous bones was required for remembering and with each some distinctive use or landmark was connected. Large sections were assigned for reading only, such as the allergies and nature of poison gases. It was recognized and so stated that the single semester was insufficient in which to cover the subject matter in detail.

The point was to gather and present an uninfluenced reaction. Opinions clashed, for what some found most helpful others found least so. The reproductive system impressed itself upon receptive minds, indicating that here is a field neglected in secondary school and home training. Some of the destructive criticism was discerning and well taken. It is this author's feeling that altogether too much space in the particular book is allotted to what well might be in the appendix for reference or else omitted altogether as more pertinent to pathology. On the whole the class found much which aided it, however, in securing an adequate grasp of the important phases of structure, function, and care of the human body.

The Trial of the Insect

Cast of Characters: *Time:* About 45 minutes

Judge Insecticide
Bailiff
Attorney for the Defense
District Attorney
Clerk
Witnesses (dressed according to their profession):

Jane Smithers
Doctor Hercermer
Farmer Jones
Mrs. Hunt
Mrs. Housewife
Miss Barton
Professor Studybug
Miss Honeybee
Jake Plowsomemore
Doctor Killem

Policeman
Insect

Scene: The scene is the courtroom of the Superior Court of the State of ———. As the curtain rises the court session is ready to open, but the judge has not yet made his appearance. The prosecution and the defense are ready at their respective tables; the attendants are around. The Insect (with wings and antennae) occupies a prominent place on the stage.

BAILIFF: Court attention! (All rise quickly and stand at attention, as Judge Insecticide enters in his robes and mounts the steps leading to his chair on the platform.) Superior Court Number Five of the State of ———. The Honorable Judge William Insecticide presiding. The clerk raps, the Judge sits, and everyone moves quickly into position.)

JUDGE: The people of the State of ——— versus the Insect.

DISTRICT ATTORNEY: Ready, your honor.

ATTORNEY FOR THE DEFENSE: Ready, your honor.

JUDGE: The clerk will draw a jury.

CLERK: (Steps to the front of the stage with

a list in his hand and addresses the audience.) You are the panel from which the jury will be selected to try this case. Twelve will be drawn. As I draw your name, please answer "present" and step up here, take your seats, and receive your instructions from Judge Insecticide. (He reads twelve names. The Jurors take their places. When the Jurors are seated, the lights in the audience go out.) Jurors, please rise—place your right hand on the book (a biology book, clearly marked) raise your right hands. (Jurors rise.) Do you promise to well and fairly try this case and render a true verdict—so help you? Say—"I do."

JURORS: I do.

JUDGE INSECTICIDE: (To the jury) Ladies and Gentlemen, you are the jurors who will try this case. At its close you will retire to the jury room and vote your verdict. I instruct you to listen to the testimony carefully and pronounce your judgment to the best knowledge of your hearts and minds. You are to determine whether the defendant is guilty of all the harm that is imputed to him. The fate of this lowly insect is in your hands. The District Attorney may now proceed.

DISTRICT ATTORNEY: Honorable Judge, members of the jury, friends. I will give you a brief explanation of this case if his honor will grant me the privilege.

I wish to explain that this insect is not on trial only for himself but for all insects in general. The insects have been accused of harming the entire world. They have been accused of damaging crops and causing the death of man. And I tell you, these accusations are just. Attorney ——— will try to prove that the insect is innocent. He will try to bring in repeatedly the point about the good the insects do in pollination. Were any of you ever stung by a bee? It hurt, didn't it? Did you feel any better to think that the bee was on its errand of mercy to pollinate some little flower? When you are inclined to be sympathetic with the arguments of Attorney ———, will you recall the following picture to your mind? If you have never seen a vine or a tree under attack by Japanese beetles, you have no idea what an appalling sight it is. Almost overnight they strip a tree or a vine of its leaves and move on to new ones. Circular No. 313 of the United States Department of Agriculture invented a plan to find out in a general way how many beetles there were in an orchard of 156 ten-year-old peach trees. Since the beetles are inactive early in the morning, these men one morning spread a large canvas under each of the 156 peach trees and then shook each tree violently. In two hours, 208 gallons of beetles were collected in this way. Not 208 beetles, my friends, but 208 gallons of beetles. By the next morning the men found the same trees as heavily laden with beetles as they had been in the morning before. As many as 278 beetles have been counted on a single apple, for they eat the fruit as well as the leaves.

Now you also know how pesky mosquitoes can be in the summer time; how the flies get into the ointment. If you find your emotions being influenced by the arguments of Attorney ——— just remember the ants and cockroaches that get into your pantry.

Consider well the arguments presented. It is a matter of life and death. The insects must be done away with or we shall all perish at the hands of this menace. I thank you.

ATTORNEY FOR THE DEFENSE: Your honor, members of the jury, friends. I am here to prove to you and the court that my client, Mr. I. Insect, who is representing all members of his species is not guilty of the accusations for which he is being tried today. Now I ask you, how can he be? How could this tiny little creature, who is so small and delicate and who has such simple little feet and body be guilty of such crimes as supposedly destroying crops and some of man's other industries costing man millions of dollars? It's utterly impossible! Did you ever stop to think of the good this creature does for mankind? We even read in the Bible: "Go to the ant, thou sluggard, and consider her ways and learn wisdom. Which although she hath no guide, nor master, nor captain, provideth her meat for herself in the summer and gathereth her food in the harvest."

If it were not for the insect where would you get your honey for eating and your

wax for candles, or your pretty silk for your dresses? Where, I say, would you get your lipstick, your lacquers and shellac?

Attorney ——— will tell you that the insect does much damage. But where will this creature get its food if not from the earth? Is it not entitled to its daily bread for the manifold benefits it gives to man? Who would wish to deprive any creature of enough food to supply energy and life to its body? No, my friends, my client is misunderstood. Day by day he goes through life striving to avoid the many weapons which man uses against him—sprays, fly paper, DDT, arsenic, Paris green. Why these Arthropods haven't a fighting chance unless we come to the rescue and strive to treat these six-legged creatures with more consideration and respect? But let's see what the witnesses have to say, what evidence they present.

BAILIFF: Will Farmer Jones please take the stand?

CLERK: Place your hand on the Biology book. Do you promise to tell the truth, the whole truth, and nothing but the truth, so help you?

FARMER JONES: I do. Gentlemen of the Jury: I'm against the insect. As a farmer I should know. Take bedbugs for instance. When they are not eating they are in cracks and crevices of old or poorly cleaned houses. They are very flat, but after they are finished eating, they are not quite so thin. For their food they prefer human blood to any other. This bedbug is known to attack certain small animals such as my rabbit, pet mice and a couple of guinea pigs. They also get after my rats—of course, I don't care too much about them.

Then take the head louse—most commonly on the back of the head and above the ears. The insect is small—less than one-eighth of an inch in length. My cat and dog have them and the only way to get rid of these lice is with kerosene. But if, after using kerosene, my dog then gets too near a fire I'll have a "hot dog."

And gentlemen, another nuisance is the root lice—always attacking my plants. And the only way to get rid of them is with tobacco—using good tobacco.

Yes sir, I'm against the insect because the bedbug and that little parasite, the louse, have caused my hair to turn gray.

ATTORNEY FOR THE DEFENSE: Your honor I would like to address a couple of questions to Farmer Jones.

Mr. Jones, you said in your talk that the insect also kills rats. Is this not helpful to you in your work?

You also said that insects are thought to be carriers of diseases. But the insects are not the only carriers are they?

Note: The answers of the witness are not given because these are more effective if they are impromptu answers.

BAILIFF: Will John Plowsomemore please take the stand?

CLERK: Put your hand on this book. Do you promise to tell the truth, the whole truth and nothing but the truth, so help you?

JOHN PLOWSOMEMORE: I do. Your honor, gentlemen of the jury: I'm here to tell you about the harm the insect does to my crops and trees. I've read that government entomologists figure that insects cost the country $1,600,000,000 a year. The records also show that of the fifty worst insect pests, about one-third of them have come from other countries, and that other insects have greatly extended their range.

The one I have a lot of trouble with is the "corn borer." Shortly before the first World War there arrived in Boston a shipment of broomcorn, the stiff-stemmed plant that is used for making brooms. In 1917 farmers around Boston found that something was eating their corn. Investigation showed that it was full of worms—dark-headed, ugly little larvae that weakened the tassels until they dropped at half mast; that ate the heart out of the stalks, attacked the kernels and bored lengthwise through the ear. Badly infested fields looked as if a troop of cavalry had marched across them. I came here today because I sincerely hope that something will and can be done to exterminate these pests.

ATTORNEY FOR THE DEFENSE: May I ask John Plowsomemore a simple question? Now you say that the corn borer arrived here in this country in a shipload of broomcorn? Would you say that if shipments and cargoes were thoroughly investigated

and the insects kept in the other countries that you would not have the trouble you do?

BAILIFF: Will Mrs. Housewife please take the stand?

CLERK: Put your hand on this book. Do you promise to tell the truth, the whole truth and nothing but the truth, so help you?

MRS. HOUSEWIFE: I do. Your Honor and Gentlemen of the Jury: I have been asked to come to this trial to testify against these insects and the harm which they do. As a housewife I do not know about every kind of insect pest that does damage but I can tell you about such pests as the cockroach, the mosquito, the termite, the bedbug, the carpet beetle, the silverfish and the firebrat.

Just the thought of roaches is revolting to housewives and other people. They thrive in filth and moisture and feed on food products. They contaminate what food they touch and cause an obnoxious odor. Their presence in a home can be considered as a menace to good health.

Another insect that I have a great deal against is the bedbug. Probably as soon as you hear that one of your neighbors have bedbugs you think that they don't clean house well or something of that sort.

Carpet beetles are responsible for a great deal of damage to woolen fabrics and other materials made from animal fibers such as felt, hair, feathers, bristles, etc.

Silverfish and firebrats feed largely on bookbindings (these are not the bookworms), the sizing of wall paper, rayon and starchy articles of clothing. Their silver-colored bodies are wingless, flat and tapered.

I hope that with this evidence I have helped to procure a fair trial for this creature, the insect. But, from what I have observed, he is a worthless creature.

ATTORNEY FOR THE DEFENSE: Mrs. Housewife, you stated that the insect, such as the cockroach, thrives in dirt and filth. That is true, but who provides these places for him and his kind?

Is it not we ourselves who do this and is it not we ourselves who are guilty of the crime by giving the insect places to breed?

BAILIFF: Will Miss Honeybee please take the stand?

CLERK: Place your hand on the book. Do you promise to tell the truth, the whole truth and nothing but the truth, so help you? Answer, I do.

MISS HONEYBEE: I do. Your honor and Gentlemen of the Jury: Did you know that the marketable crop of honey in the United States can be as high as 7,900,000 lbs. a year? Just think how hard the bee must work to accomplish this total. Honey is valuable as food because it contains so much nourishment. It is used frequently in place of sugar. Besides this great accomplishment of honey the bee also produces much valuable wax. Wax is used to make candles, to keep the lather from drying out too quickly in shaving creams, in cold creams, cosmetics, polishes, floorwaxes, crayons and electrical products.

I'll bet a lot of the girls did not know they are indebted to the insect for much of their lipstick. The cochineal insect is colored a beautiful carmine red. The pigment is the dried pulverized bodies of a kind of scale insect. It requires 70,000 insects to make a pound of cochineal. Rouges and lipstick are made from this. It is also used for coloring medicines and beverages and for permanent dying.

Silk, although not too popular in the United States, is imported from China. This silk, produced by the caterpillar is very valuable because of its length. Each silkworm can produce this substance at the rate of 6 inches per minute. Raw silk is marketed each year to the United States at the rate of 70,000 pounds. Many of our expensive dresses and other garments are made from this fine-textured fiber of silk. So, you see, this insect does much good.

DISTRICT ATTORNEY: Your Honor, may I ask Miss Honeybee a question? Is this not true, Miss Honeybee that no one would have to die if they could not get honey, lipstick and crayons? Is it also not true that silk is not too popular here in America and does not therefore appear too important to the American?

BAILIFF: Will Jane Smithers please take the stand?

CLERK: Put your hand on the book. Do you promise to tell the truth, the whole

truth and nothing but the truth, so help you?

JANE SMITHERS: I do. Your Honor, Members of the Jury, Friends: There are some witnesses here that are against the insect, and some are for it. I am proud to say that I am for it. I am going to give you one reason why I believe that the insect is good. The in-ect does a very wonderful job when it comes to helping man and plants in pollination. The little insect, or sometimes more commonly called "bug," goes from plant to plant acquiring food, and as it does so pollen from the plants either sticks to its legs or to the body and antennae. Then the insect goes to another plant and deposits it thus performing pollination for the flower. Do we realize that if it weren't for the in-ect we would not have many fruits and vegetables including melons, beans and peas? Do realize that many beautiful flowers such as lilies and roses would not be found if it were not for the insect?

DISTRICT ATTORNEY: Is it not true, Miss Smithers, that we can live without the things you mentioned like melons, lilies, roses, etc.?

BAILIFF: Will Miss Barton please take the stand?

CLERK: Place your hand on the book. Do you promise to tell the truth, the whole truth, and nothing but the truth, so help you?

MISS BARTON: I do. I am here to defend the insect, and I hope that what I say will help convince you too that he is innocent. I first met the defendant on my vacation, at a little farm near ——— (some local nearby town). By watching him I learned to understand him and soon realized how this creature, small as it may be, teaches man a lesson both in social and industrial life.

Since early Biblical times the honeybee has been a symbol of industry and honey a simile of plenty. The study of honeybees and their remarkable life history has inspired philosophers whose writings are replete with references to them.

The forerunners of modern inventors were not great men, no, my friends, they were not great men, they were the insects. This may seem incredible to you, but it is true. Before primeval man had learned of fire or dreamed of the use of coal, the social bees were employing in hive ventilation the identical principles that industry now uses in keeping pure air in modern mines. Also the bombardier beetle employed gas against his enemies unnumbered centuries before man resorted to gas warfare. Man has learned from these tiny creatures the understanding of the nervous system, principles of cold storage and sterile preservation. We even have a few expressions of theirs, such as "busy as a bee," "make a beeline," both of which refer to the bees' remarkable way of working. Thank you.

DISTRICT ATTORNEY: Miss Barton, you mentioned the fact about the bombardier beetle employing gas against his enemies. Do you think this is a good example for man to copy?

BAILIFF: Will Doctor Hercermer please take the stand?

CLERK: Place your hand on the book. Do you promise to tell the truth, the whole truth and nothing but the truth, so help you?

DOCTOR HERCERMER: I do. Your Honor and Gentlemen of the Jury: I have been asked to testify at court today. In contact with people I have come to the conclusion that insects are harmful to man because they produce many diseases from which man suffers.

One of the most harmful to man is the Tsetse Fly. The Tsetse Fly is about the size of a hou-efly, it rules an area larger than the United States in Africa. The disease produced in man is "Sleeping Sickness," and I know from my experiences that this disease can be very serious. The Tsetse Fly sucks blood contaminated by Trypanosomes which cau-e Sleeping Sickness. When the fly bites a man it infects him with these germs.

Another common insect which most people think is only a pest, is the housefly. But it can spread many germs and diseases by the hairlike structures on its feet, then by walking across the food we eat the germs are passed on to us.

I know that most people think that the mosquitoes are only pests because of the bites they inflict. But if there were no

mosquitoes there would be no malaria. Malaria, especially in the tropics, is a dangerous disease. When a mosquito carrying malaria germs bites a person, it leaves in the wound some of the germs which may grow and cause malaria.

Yellow fever is another disease which is carried to people by insects, by a different kind of mosquito.

Yes, members of the jury, the fly is a menace—and so are the other disease-producing insects. It has been proved that flies are responsible for the death of more people than all the wild beasts in the jungle.

ATTORNEY FOR THE DEFENSE: Now, Doctor, you said that the insect produces many of man's diseases. Are you sure of this? Have you made enough experiments to be sure of this statement? You said that the Tsetse Fly causes sleeping sickness? Did you know that with the new drug, *Antrycide*, the way is now open for the conquest of this disease?

BAILIFF: Will Doctor Killem please take the stand?

CLERK: Place your hand on this book. Do you promise to tell the truth, the whole truth, and nothing but the truth, so help you?

DOCTOR KILLEM: I do. Gentlemen of the Jury, friends: I was called here to testify how insects help in the use of medicine. All insects are not harmful as most people think. Why, if it weren't for insects we would not be able to carry on our everyday life. A few of the insects which help us are the praying mantis, which destroys other insects, the silk worm pupa which makes silk and the honey bee which produces honey and wax. But the one I am particularly interested in is the mosquito which helps conquer Malaria by permitting the doctors to inject the malarial drugs into them. (Of course, the mosquito doesn't have much say in the matter). The mosquito is drugged by mixing the drug with food in his food jar. Then I allow the mosquito to bite a chick to get results.

After I have done all this I decide to dissect the mosquito and look for the malarial parasites. To get to the stomach I remove the abdomen. After that I remove the salivary glands which contain other forms of parasites. These mosquitoes containing the malarial parasite in their salivary glands are permitted to bite patients having certain kinds of insanity. The malarial fever is sufficient in certain cases to cure the insanity. After the insanity is cured, they then give the patient quinine or some other drug to reduce the malaria. So you see insects are helpful in medicine and not all insects are harmful.

DISTRICT ATTORNEY: Is it not true, Doctor Killem, that for most experimental studies mice, guinea pigs, and monkeys are used and could, perhaps be substituted for the insect?

BAILIFF: Will Professor Studybug please take the stand?

CLERK: Place your hand on the book. Do you promise to tell the truth, the whole truth, and nothing but the truth, so help you?

PROFESSOR STUDYBUG: I do. Gentlemen of the Jury: I was called here today to testify about the work of the insect as a scavenger. I am a biologist and I know from experience that many people think only of the harm that the insects do. But what about the ladybird beetles, the dragonflies, the ground beetles and the lacewing flies which either eat wholly or eventually destroy plant-eaters and harmful insects which ruin garden plants and vegetables? You should also think of the ichneumon fly, the digging wasp, the braconid wasps which are parasitic on harmful insects.

It is a fact that the best control of plant-eating insects is not the bird nor a spray but other helpful insects. The boll weevil which is very destructive to cotton is checked by certain wasps that prey upon them.

I would like to give you a spectacular example of the work of the ladybug beetle. When 140 of these little beetles reached San Francisco from Australia, the cottony-cushion scale was ruining the lemon and orange groves of the region. The beetles began devouring the insects at a tremendous rate. In a few years they have saved the threatened groves single-handed. We can thank these little beetles for all the oranges and lemons coming from California today. If it had not been for these

helpful insects it would not be possible.

DISTRICT ATTORNEY: You mentioned, Doctor—I mean Professor—Studybug, that it took 140 beetles a few years to save the grove, is that right? Doesn't this show that what the harmful insects did to the grove in a few days or weeks it took years for the other insects to save the grove, costing the loss of the lemons and oranges already destroyed?

BAILIFF: Will Mrs. Hunt please take the stand?

CLERK: Place your hand on the book. Do you promise to tell the truth, the whole truth, and nothing but the truth, so help you?

MRS. HUNT: I do. Your Honor, Gentlemen of the Jury: I have been a housewife for many years and now I believe all insects should be destroyed for what they do to the house and food.

Take the fly for one example. It is very troublesome in the kitchens and dining rooms because of the great numbers in which they come and because of its tendency to get into food.

The cockroach is another example of an insect which spoils foods and ruins furniture. How would you like it, members of the jury, to have company for the evening and to have cockroaches running over your furniture and floors?

ATTORNEY FOR THE DEFENSE: But Mrs. Hunt, is it not true that if you would keep your food covered and put into the right places, you wouldn't have the creatures in the food?

DISTRICT ATTORNEY: Gentlemen of the Jury, you have heard the evidence. Please do not let your verdict be influenced by your emotions of pity for the insects. Remember the damage they do, when you cast your vote. As Attorney ——— has said, one percent of all the insects are harmful and fifty percent are good. But that one percent, gentlemen, can do more harm than than the fifty percent can do good.

Do not forget the millions of dollars our country must spend to protect us from these enemies. It is your money that is spent, your life and your security is at stake. You and you alone can save yourself and the entire world from destruction by the insects. Please remember this is a matter of life or death, your life or your death. I thank you.

ATTORNEY FOR THE DEFENSE: Now that we have arrived at the conclusion of the case, let us summarize it. Members of the Jury, you have listened to the accusations made by Attorney ———, and the evidence presented by the witnesses, evidence that tells you how the insect helps in the expansion of medical science, in the pollination of our flowers and our crops. You have heard about the number of useful products they supply to us daily. The fate of Mr. Insect is now in your hands. I have presented my case and my evidence to the court. It is up to you to decide if the insect will go free or be executed. I can only say that I hope you will arrive at a just and fair decision. But while you are making this decision, keep this question in mind. "Where would I be if it were not for the insect?" I thank you.

JUDGE INSECTICIDE: Gentlemen of the Jury: The Bailiff will now escort you to the jury room. I shall ask you to consider your verdict carefully—omitting all personal prejudices and sympathies. Forget about the mosquito that bit you or the fly which fell into your soup. I shall ask you to adhere strictly to the evidence, and to bear in mind the many points of evidence presented. You are to determine only whether the insect is to be permitted to live on this earth in spite of his bad aspects, or whether he should be exterminated immediately with a "buzz bomb."

The Jury goes out and comes back with a verdict. If the verdict is "guilty" the judge imposes the sentence of death to be executed the next morning at dawn. If the verdict is "not guilty," the insect shakes hands with his lawyer and the case closes.

Editor's Note: *The Trial of the Insect* is a script for an assembly program worked out by members of the biology class of Sister Mary Hubert, S.N.D., of St. Peter's High School, Cleveland, Ohio. Sister Mary in her accompanying letter says that students derive most benefit from looking up materials and composing the speeches of the witnesses.

MARTIN, W. EDGAR. *Selected Tests in Biology and Related Areas.* Circular No. 308–III, For Grades 7–14 Inclusive. Office of Education, Federal Security Agency, Washington 25, D. C. 1949. Free.

This Office of Education circular furnishes the biology teacher with information on the availability of sixty-seven prepared tests in biology and related areas of health, safety, and some of the basic skills for problem-solving. Descriptive annotations are included with each test listed. Also contained are sources where a more extended critique of the tests may be secured. The following depiction will indicate the worth of this work to the teacher.

"Biology: Every Pupil Test. For high school grades. A new form usually issued each December (1st semester) and April (2nd semester). Working time 40 (45) minutes. Ohio Scholarship Tests. Matching and multiple choice questions on factual information and questions on the identification of parts of diagrams."

When writing to Dr. Martin for this publication, please mention *The American Biology Teacher* as your source of information.

REED, HOWARD S. *Jan Ingenhousz—Plant Physiologist*—With a History of the Discovery of Photosynthesis. Waltham, Mass.: The Chronica Botanica Co.; New York City: Stechert-Hafner, Inc. 1949. illus. $3.00.

Jan Ingenhousz, a scientist of the eighteenth century, contributed much toward laying a sound foundation upon which modern experimental biology is built. He was one of the eminent physicians of his time. However, his intellectual interests extended beyond the field of medicine. Although he was not a botanist, as we classify them today, he conducted extensive experiments on photosynthesis. While Ingenhousz did not furnish the final answer on photosynthesis, it is amazing that he accomplished so much with the few and simple pieces of apparatus, and the limited number of chemicals at his disposal. For that matter, current plant physiologists with their modern equipment and scientific training have not obtained the last word in this field. Ingenhousz occupies an honored position among scientists for his careful and extensive experimentations and his ability to draw and report conclusions from his data.

The book under review includes a complete reprint of Ingenhousz's *Experiments Upon Vegetables*, considered a classic of plant physiology and photochemistry. The author has included much introductory material, as well as a general history of the discovery of photosynthesis. Many of the illustrations, previously unpublished, were obtained by the editor from the Netherlands archives. This book will interest physiological and medical historians.

LEE R. YOTHERS,
High School.
Rahway, New Jersey

HEISS, ELWOOD D., OBOURN, ELLSWORTH S., and HUFFMAN, CHARLES W. *Modern Science Teaching.* The MacMillan Company, New York. 1950. 462 pp. $4.50.

Modern Science Teaching appears to be more useful and practical for the general classroom teacher and for the student preparing to become a science teacher than its predecessor, *Modern Methods and Materials for Teaching Science.* The revised tome has a shorter title; its photographic illustrations are more numerous, clear and more pertinent; its organization is more logical and more comprehensive with a questions and exercises section along with an up-to-date selected references listing at the end of each chapter. The addition of equipment lists for teaching various sciences in the appendix makes the book of greater value to the beginning teacher of science. Teachers of specific fields in science will not get the specialized help available in several other books. However, they as well as supervisors of science, science educators and general science instructors at all levels are given an interesting broad view of the problems—underlying philosophy, objectives, methods, evaluation, psychology and "tricks of the trade"—of science teaching and are provided with an excellent source book of equipment and sensory aids.

ELMO N. STEVENSON,
Southern Oregon College of Education,
Ashland, Oregon

STEBBINS, G. LEDYARD. *Variation and Evolution in Plants.* Columbia University Press, New York. xix + 643 pp. illus. 1950. $8.00.

Botanists and general biologists will find the latest advances in our knowledge of plant evolution from all the relevant fields; systematic botany, ecology, genetics, cytology, morphology, anatomy, paleobotany and plant geography. It is also the first general work on its subject to discuss the relationship between evolution and the "New Systematics" of plants.

The author presents a new theory to account for the major trends in the reproductive system of plants, particularly the alternation of generations. His theories on the nature of barriers between species, on types of polyploids, and on the causes of different rates of evolution in different plant groups are also included. There is a discussion of the theories of Sewall Wright on the effect of chance variation in evolution, as well as an evaluation of the evidence for assuming that hybridization between species has a strong effect in speeding up the rate of evolution.

Certain concepts, according to the author, of the nature of evolution seem now to be so well founded that they are taken as major premises on which the arguments of this book as a whole are based. The first of these is that evolution must be considered on three levels; first that of individual variation within an interbreeding population or within a single colony of an asexual organism; second, that of the distribution and frequency of variants within a system of actually or potentially interbreeding populations, and third, the separation and divergence of populations as a result of the building up of isolating mechanisms, or the origin of species and consequently of separate evolutionary lines. The second major premise is that at all three levels evolution has progressed chiefly by the accumulation of small changes, each with a relatively slight effect, rather than by single great jumps. The third premise is that the speed and the direction of these changes have not been constant in any one line. On the contrary, evolution appears as a sort of progressive opportunism which in both direction and speed is regulated at any one time by the genetic constitution of the population and the environmental influences acting upon it at that time.

In brief, evolution is here visualized as primarily the resultant of the interaction of environmental variation and the genetic variability occurring in the evolving population.

CHARLES C. HERBST,
Beverly Hills High School,
Beverly Hills, California

RAND, HERBERT W. *The Chordates.* Blakiston Co., Philadelphia. 1950. ix + 819 pp. illus. $6.00.

Mr. Rand's book is written especially to serve as a reference or text for comparative anatomy of vertebrates. It is written to give anatomic facts, something of the history of anatomic science, and an appreciation of its vital human import.

Following a short prologue entitled, Why Study Vertebrates, the book is divided into three main parts with nineteen chapters: Part I, Basic Structures of Vertebrates, general features, the alimentary tube and its respiratory derivatives, circulatory, excretory and reproductive, motor and skeletal, integrative, reproductive systems and histology, pp. 11–330; Part II, History and Method of Comparative Anatomy, pp. 333–384; Part III, The Comparative Morphology of the Vertebrates, pp. 389–784, Protochordata, Ichthyopsida, Reptilia, Aves, and Mammalia; Epilogue, What Comes of Studying Vertebrates.

The book has a good cloth binding, with 9 × 6 page size. It is illustrated with many excellent drawings and photographic reproductions and has a good 20-page index. The book is carefully written in understandable English. The objectives of the author have been well achieved. Certainly it should be a valuable reference, not only for comparative anatomy students, but also for zoology and general biology.

M. A. RUSSELL,
Highland Park Junior College,
Highland Park, Michigan

LETTERS

Sir,

As a subscriber to "The American Biology Teacher," I am a member of your Association.

So far I have received five copies of the Magazine and I have found some of the articles contained therein very interesting. I am, however, forced to agree with a certain writer in your January issue regarding the lack of articles on newer practices and methods in teaching Biology. May I, as one who is interested in Science teaching, suggest that a part of each issue be devoted to: enquiries from readers, problem-solving methods, new biological apparatus, "how to do" articles, etc.

Permit me to start the ball rolling by making this request: "Can any of your members suggest a method of making a hand microtome from materials found in the home?

Yours faithfully,

LIM ENG THYE

Editor's Note: The address of the writer of this letter was misplaced; if he will send it to the editor it will be printed, so that other readers may get in touch with him.

Old time readers of *The American Biology Teacher* may recall an article describing the construction of a hand microtome. It was printed in the February 1943 issue. The authors, Tom Sergeant and Delbert Hawkins were at that time teaching in the high school at Cedar Vale, Kansas. The prices listed at the end of the article are of course 1943 prices. The editor would appreciate hearing from either or both of the authors; perhaps they have produced other types of home made equipment of interest to biology teachers.

Building a Microtome

Prepared slides of actual tissues offer an excellent means for objectively teaching the biological sciences. Since our school budget did not permit, a factory-built microtome was out of the question. Even the cheapest hand microtomes were too expensive, and were not as good as desired.

With the invaluable aid of a talented student, plans were drawn up for an automatic "slicer" that should work. We had to have rigid parts so we chose aluminum. Its melting point, 657° C. or 1220° F., is low enough for an ordinary forge or gas furnace and it is hard enough to resist reasonable wear. Lead was tried and found much too soft to be serviceable. Wooden patterns were made of each part. These wood templates were then pressed into potter's clay to make an impression. Common red clay can be used, but casting sand is better. The aluminum was heated in a babbit ladle until fluid and poured into these impressions. The best casts were taken from molds that had been heated thoroughly before the metal was poured into them.

Five different cast pieces make up the machine. Considerable filing and grinding was necessary before the rough casts could be fitted together so as to hold a razor blade and automatically cut paraffin sections nineteen microns thick as fast as the holder could be turned.

About five pounds of aluminum were used, largely metal trimming from the running-board of an old car. One necessary part was a three-inch wheel which was turned out on the manual class wood lathe by using the end of a file as a cutting tool. The other parts were dressed down with an emery stone and flat files.

The whole instrument was built around a ninety-five cent micrometer purchased from a mail order company. The blade-holder turns on its axle and in making one revolution, it turns a "webb" which in turn advances a notched wheel one notch. This wheel fastened to the mi-

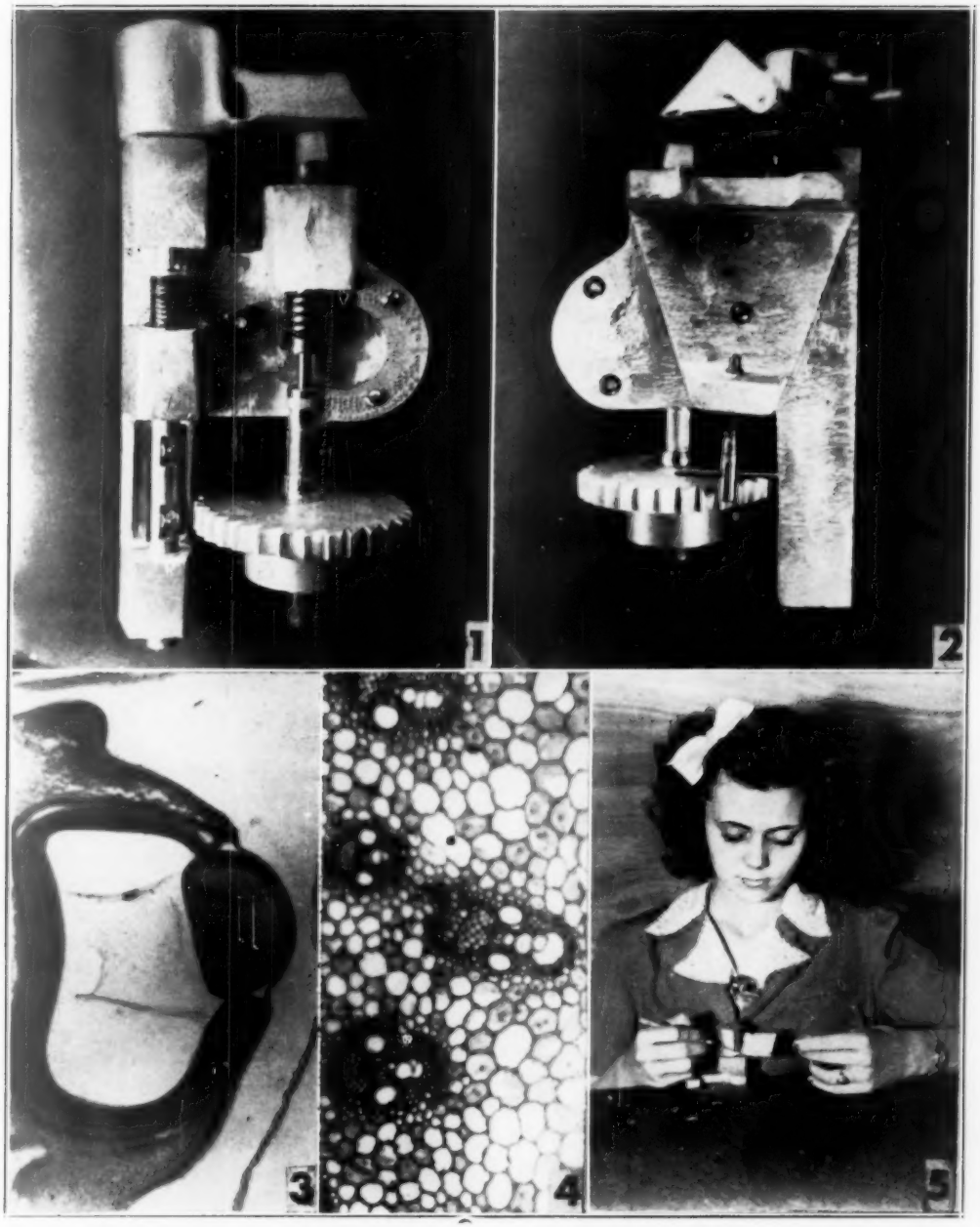

Fig. 1. Front view of microtome with paraffin block in place.
Fig. 2. Rear view showing bolts holding head and axle, and blade holder parts.
Fig. 3. Section through eye region of three-day chick embryo. Lens and lens fibers. 200×.
Fig. 4. Section of young corn stem. 200×.
Fig. 5. Removing a section to a slide.

crometer spindle causes the spindle to advance a given distance each time the blade makes its section. The axle is a $\frac{3}{8}$″ steel rod that can be made by sawing the valve head from the shaft of an automobile valve. Any sized rod may be used. Springs which fitted the shaft were cut for length and held in place by pins driven tightly into holes drilled in the shafts. Holes were drilled in the head and in the frame where the shafts fitted. This drilling was done on the lathe in order to line up the holes. By putting thirty-two notches in the wheel we could get sections 1/1280 inch or 19 microns in thickness. Double-edged razor blades are held in place between the jaws of the holder, by a bolt which screws in from behind. The holder is held rigidly to the axle by the same means. The threads were easily tapped with a twenty-five cent tap and holder. The razor holder is composed of two parts carefully filed so that they meet the blade evenly and firmly. A nail serves as the pin which holds both parts together. A clamp was cast to hold the machine at table level. A factory-made clamp could be bolted to the frame.

This machine has been used in the biology class for cutting tissues of various kinds. Some actual photomicrographs of student-made slides are shown in figures 3 and 4. These photographs were taken and processed by students.

The extra teaching value in interest and true understanding on the part of the students more than repay the slight expense and long hours of work necessary in making this machine.

Materials used and money spent are as follows:

1	drill bit 3/16″	.10¢
1	drill bit $\frac{1}{8}$″	.10¢
1	drill bit $\frac{3}{8}$″	.10¢
10 lb.	potters clay	.15¢
5 lb.	aluminum (pans and car trimming)	
1	steel rod $\frac{3}{8}$″ × 9″ (old automobile valve)	
1	steel rod $\frac{3}{8}$″ × 3″	
1	metal tap and holder	.25¢
2	bolts $\frac{1}{8}$″ × 1″ (to hold micrometer to frame)	
3	bolts to fit threads of tap (found in laboratory junk box)	
2	bolts $\frac{1}{8}$″ × $\frac{1}{2}$″ (to hold webb to long axle)	
2	nails (pins to hold springs in place; pin to hold razor holder parts together)	
2	springs (cut from one—donated by student)	
2	bolts 3/16″ × 1″ (to hold clamp to frame)	
1	1″ micrometer	.95¢
3	flat files	.50¢
	Total	$2.15

BIOLOGY LABORATORIES

By "The Old Fossil"

At Lane Tech, Chicago

Living Light. Dr. Harvey of Princeton has made an intensive study of living light. Facts listed are in the realm of pure research and have little place in class study, but they might be used to introduce a subject. "Fox Fire" is the name applied to a fungus which grows on decaying wood and glows at night, outlining the shape of the stump or log on which it grows. Robert Boyle three hundred years ago placed a piece of this wood under a vacuum and proved that oxygen was necessary for the glow to be produced. Here is one to introduce a topic on symbiotic relationships: It is a very strange relationship between a fish of the Dutch East Indies and bacteria. Schools of these fish flash winks of light at regular intervals. This is accomplished by drawing a fold of skin down over the light. The light comes from a colony of bacteria growing on the organ. The bacteria derive their food from the fish. Illustrating complicated functional living: The mechanism of the light of the firefly is complex. The setting off of a flash is similar to a muscle movement; but the trigger mechanism that starts the light shining has not been determined. To introduce species variation: each variety of firefly has a character-

istic method of flashing, distinguished by length and rapidity of flashes. Or the "railroad worm" in South America has a row of yellow lights along its sides and a red light on one end. Each may be operated separately or together. Or marine form variations: the squid off Sicily, unlike the other squid, surrounds itself with a brilliant, luminous liquid when disturbed. Such factual introductions tend to get the attention of the student. A biology teacher can not have too many of these attention getters—to be used discretely of course.

Day Vision vs. Night Vision. Biologically there are two distinct types of vision according to Dr. Hecht of Columbia. With our day vision we are able to detect delicate lights and shadows, colors and forms. This is between sunlight and moonlight. With less intensity than moonlight (night vision) we recognize only coarse shadows, no colors, and we perceive things vaguely. But to compensate for this we are able to pick out the faintest lights. You can see a candle fourteen miles away at night. A good experiment is to have pupils test out these facts. The atmosphere must be clear of haze or mist. City dwellers do not have such an opportunity within their area but must go out many miles. Man has excellent night vision and pilots are trained to take advantage of this ability. Moles, mice, and owls have night vision. Chickens, turtles, and many hawks have only day vision and go to sleep with sundown.

Vision For Air Force personnel must be at top-flight efficiency at all times. The men are checked for such visual characteristics as depth perception, muscular coordination, astigmatism, and vertical and lateral phoria. The government maintains eye testing equipment for these characteristics where ever air personnel are stationed for active duty. Ground personnel for the same force must have 20–20 vision with lens correction. You are going to be teaching this information to your students in the biology of flight. Write me if you are interested in getting the names of apparatus used for these purposes.

More Light and better light is claimed for a new microscope illuminator. It uses an ordinary forty watt bulb. It is also adjustable to any position and has an anti-glare eyeshade to protect the eyes of the operator. Name of the manufacture on request.

Aluminum Foil in rolls is now available in most stores. They have found dozens of uses of this for laboratories. It is especially helpful in wrapping moist materials to be carried on hikes. Get a roll; you will make your own uses without our aid.

Genes, Vitamins, and Nutrition. You might use the following to tie up the three topics which these represent. The genes of our bodies exist in such a condition that our bodies are incapable of manufacturing vitamins. Many plants on the other hand are able to make vitamins because of certain genes which they have. Certain functioning genes control particular chemical formations. It has been found that the red bread mold is able to make all the vitamins of the B group. By exposing these cells to X-rays, ultraviolet light, and other types, their vitamin production capacity can be influenced with the different radiations. Man is defective in ability to manufacture these vitamins and construct amino acids. Our study of bread mold helps us to understand how these substances are made in other organisms. This knowledge is important to us in the study of nutrition.

T.O.F.'s Mental Notebook was replenished with some biological facts as he took a two day turn around Lake Michigan the last week in August. The drive along the north shore is as scenic as the drive along the Pacific. In the dunes area they have established many varieties of the deep rooted evergreens. They also pin down these dunes with a long rooted grass which they plant in clumps about a foot apart. Dunes are on the north, and south-east shores. Many thousands of grass frogs for teaching biologists originate in the commercial collecting areas of Green Bay, Wisconsin. Shallow aquatics and sedges are found in the bays of north-west Lake Michigan. Algae, fungi,

(*Continued top of page 47*)

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In order that readers may know who carries the chief responsibilities in the activities of THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS and *The American Biology Teacher* it is the policy of the journal to publish twice a year, in the November and February issues, a complete list of the staff members. Lists of chairmen and personnel of committees are published in connection with reports of their activities.

All these individuals are deeply interested in the improvement of both the association and the journal. They welcome suggestions from members and are ready to give assistance to anyone interested in writing items or other articles for the journal.

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Manuscripts for publication in THE AMERICAN BIOLOGY TEACHER should be typewritten, on one side only, on standard white paper, 8½ × 11 inch size, with a margin of at least an inch on all sides. The writer should keep a carbon copy for reference and as insurance against loss of the original in transit.

Articles are scheduled for publication in approximately the order of acceptance of the manuscripts. Generally the journal is tentatively arranged about three or four issues ahead, and there are under consideration at any time enough manuscripts for about two or three more issues. Some space is of course allowed for news items and articles of a seasonal nature. On the average, a manuscript submitted this month may expect to find its way into print, if it is accepted promptly, in about May or October. Many seasonal papers have to be postponed an entire year, simply because the author has not allowed the necessary four to six months that intervenes between acceptance and publication.

For details concerning titling, headings, references, illustration, etc., consult *Preparation of Manuscripts for Publication*, which appeared in the November, 1949, issue of THE AMERICAN BIOLOGY TEACHER. A limited number of reprints is still available; copies may be obtained from the editor.

Manuscripts may be sent to the editor-in-chief or to any one of the associate editors. A complete list of the latter appears in each October and February issue.

(Continued from page 43)

mosses, liverworts, lycopodia, and other ground pines, are found in the dense floors of the forests. Commercial fishing is at many points, especially Port Washington. Time yourself for a fish dinner in this town; ask any native where to go or consult Duncan Hines. At Easter Tide is the smelt run. In the same area will be found traps for the Lamprey which is invading the entire Great Lakes area.

ACTION BIOLOGICAL: saw one car driving off the road on the berm. Riding on the running board of the car was a man with an extended insect net held close to the ground. A new way of collecting insects.

IDEAL PICTURES is the name of a firm that handles silent and sound pictures and film strips. They have offices extending from Boston to Honolulu. Write them for their 1951 Catalogue. The office located at 58 East South Water Street, Chicago 1, Illinois, will see that your inquiry is placed in the office nearest your home for service.

THE OLD FOSSIL is always glad to hear from readers. You will get an answer, to your troubles, or to your suggestions, or to what ever pops into your mind. The Old Fossil, 5061 North Saint Louis Avenue, Chicago 25.

PREMEDICAL EDUCATION CONFERENCE

Alpha Epsilon Delta, National Premedical Honor Society, announces the celebration of its twenty-fifth anniversary, at the University of Alabama, Tuscaloosa, Ala., March 21–24, 1951.

Alpha Epsilon Delta has always had as its educational objective to stimulate an appreciation of the importance of premedical education in the study of medicine and to promote cooperation between medical and premedical students and educators in developing an adequate program of premedical education. The common ideals which have governed the Society were expressed in the original draft of the first Constitution: "The object of Alpha Epsilon Delta is to encourage excellence in premedical work, to bind together similarly interested students and to act as a force in crystallizing any movements for the good of the premedical student." On March 23rd and 24th, medical and premedical students and educators from colleges and medical schools in the southeastern area will join with Society members to participate in the Fourth Regional Conference on Premedical Education.

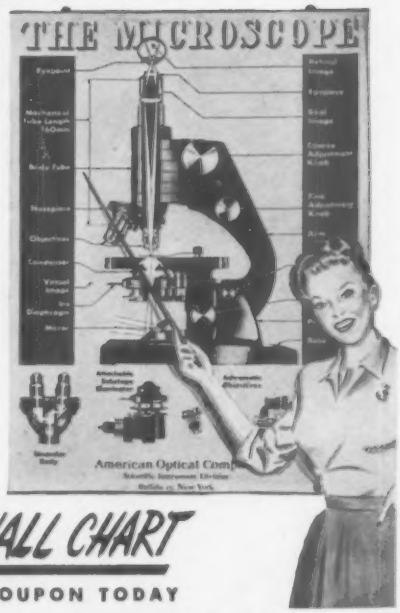
BIOLOGY INSTITUTE DAY

The Second Biology Institute Day was held at Duquesne University on Saturday, March 3, 1951.

The principal address of the morning session was "Botanical Interpretation of an Aerial Photograph." The afternoon sessions were held in four sections—Genetics, Laboratory Techniques, Ecology, Visual Aids. The president of the Association is Rev. Ulric Thaner, O.S.B., St. Vincent High School, Latrobe, and the secretary is Sister M. Regina, O.S.B., St. Benedict Academy. The chairman of the biology section, who sent the announcement to the American Biology Teacher, is Sister M. Gabriella, O.S.F., St. Vincent High School, Latrobe.

Every Science Class should have this *WALL CHART*

This chart is invaluable for teaching microscopy or optics to science classes. It includes a simplified, easy-to-follow light path and *both* optical and mechanical nomenclatures.



FOR *YOUR FREE WALL CHART*

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Date_____

GENTLEMEN: Yes, I would like a free wall chart for my classes.

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